COMPUTER ENGINEERING DEPARTMENT

Graduation Project Proposal Form

CMPE 405 /CMSE 405 /BLGM 405

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| Instructor Name: | Prof.Dr.Duygu Çelik Ertuğrul |
| Project Title: | Municipality Smart City Application (A Mobile App for Gazimağusa Municipality) |
| Number of team members: | 4-5 students |
| Semester & Year: | SPRING 23-24 |
| Type of Project (HW/SW): | SW |

# Project proposal should be in accordance with ABET requirements, which are stated as: “The curriculum must include a culminating major engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints, and 2) is based on the knowledge and skills acquired in earlier course work.”

# 1. Project Overview

**Objective**: The primary goal is to enhance urban services, efficiency, and citizen engagement through a centralized digital platform.

* **Scope**: Inclusion of key municipal services such as news/announcements, help desk services, maps management, waste management, traffic control, public safety, citizen communication, and more.

Students engaged in the development of a Municipality Smart City Application will have diverse roles and learning opportunities. Developers will code the application's frontend and backend, UI/UX designers will create user-friendly interfaces, and database administrators will manage data storage. IoT specialists will integrate smart infrastructure, data analysts will extract insights for urban planning, and quality assurance testers will ensure the application's functionality and security. Project managers will oversee coordination, documentation specialists will create user guides, and reports. Students will acquire technological skills, collaborate in interdisciplinary teams, develop problem-solving abilities, and gain project management knowledge. They will also focus on user-centric design, ethical considerations, community engagement, and continuous learning, contributing to a holistic learning experience in urban development and technology.

**2. Detailed specification of the project**

SOME FEATURES YOU CAN CONSİDER:

* Information About Gazimağusa Municipality (All information available on the website)
* About the Mayor (Curriculum Vitae)
* Send Message to the Mayor Button
* News and Announcements
* Online Payments (as available on the website, SOME STEPS OF THIS FEATURE CAN BE DEVELOPED!!! )
* Tender Announcements
* Collected Vehicles
* Shelter for animals
* Important Phone Numbers
* Bus Tracking Application Integration
* Weather Widget
* Complaint Panel with Photos (Users taking and submitting photos of issues such as roads, waste, etc., integrated into the municipal system)
* Restaurants
* Pharmacies on Duty
* Historical/Touristic Places
* Government Offices' Contact Numbers (as available on the website)
* Social Media (its Web TV on YouTube, Instagram, and Facebook)
* Request and Complaint Forms
* Contact Button (One-click access to WhatsApp and phone lines)
* Payment Point Locations
* Hospital/Health Center Locations
* Waste Collection Days
* Map of Disaster Gathering Points (From Civil Defense)
* Municipal News - Addition of a feature to send users notifications for news marked with a priority title in the application.

**NOTE: Students can download similar/existing mobile applications belong to different municipalities from online mobile app stores as exemplary solutions and examine and analyze them to determine your own system features. Try to be innovative.**

# 4. Standards that should be used in the project

In this project, several standards can be considered and implemented to ensure quality, interoperability, and compliance. Here are some relevant standards that can be used:

* **ISO/IEC 27001:** Information Security Management: This standard provides a framework for establishing, implementing, maintaining, and continually improving an information security management system. It's crucial for ensuring the security of citizen data and sensitive municipal information.
* **ISO/IEC 25010:** Systems and Software Quality Requirements and Evaluation (SQuaRE) - System and Software Quality Models: This standard defines a quality model for systems and software. It can be used to define and measure the quality attributes of the Smart City Application, such as performance, reliability, usability, and maintainability.
* **ISO 20022:** Financial Services – Universal financial industry message scheme. If the application involves online payments or financial transactions, ISO 20022 can be employed for standardizing the messaging format, facilitating interoperability between different systems and financial institutions.
* **ISO 37106:** Sustainable cities and communities — Guidance on establishing smart city operating models for sustainable communities: This standard provides guidance on establishing smart city operating models. It can be used to ensure that the Smart City Application aligns with sustainable and resilient practices.
* **OGC (Open Geospatial Consortium) Standards:** For applications involving geographic information systems (GIS) or mapping, OGC standards such as WMS (Web Map Service) and WFS (Web Feature Service) can be implemented for interoperability.
* **ITU-T Recommendations (e.g., ITU-T Y.2060):** Smart Sustainable Cities - A global overview: ITU-T provides recommendations for Smart Sustainable Cities, offering guidance on the integration of ICT in urban areas. These recommendations can help align the project with global best practices.
* **IEEE 802.15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs):** If the project involves IoT devices and sensors, IEEE 802.15.4 can be used for low-power, low-data-rate wireless communication, suitable for IoT applications.
* **GDPR (General Data Protection Regulation):** While not a technical standard, adherence to GDPR principles is essential for protecting the privacy and rights of individuals whose data is processed within the Smart City Application.
* **HTTP/HTTPS (Hypertext Transfer Protocol/Secure):** For secure communication over the web, adherence to HTTP/HTTPS standards ensures data integrity and confidentiality.
* **Web Content Accessibility Guidelines (WCAG):** To ensure the application is accessible to users with disabilities, WCAG standards can be followed, promoting inclusivity and usability.

When implementing standards, it's essential to consider the specific requirements of the municipality, the nature of the Smart City Application, and any local regulations that may apply. Additionally, staying informed about emerging standards and best practices in smart city technologies is crucial for continuous improvement.

# 5. Constraints

Here are some possible constraints you may want to apply to your project:

**1. Data Privacy and Security:**

* Constraint: Adherence to data protection regulations and ensuring the security of citizen data.
* Considerations: Implement robust encryption, secure APIs, and access controls. Regularly audit and update security measures to stay compliant.

**2. Interoperability:**

* Constraint: Ensuring that the Smart City Application can integrate seamlessly with existing municipal systems, databases, and third-party applications.
* Considerations: Follow open standards, use widely accepted data formats, and consider APIs for system integration.

**3. Usability and Accessibility:**

* Constraint: The application should be user-friendly, accessible to people with disabilities, and available in multiple languages.
* Considerations: Conduct usability testing, adhere to Web Content Accessibility Guidelines (WCAG), and provide language localization options.

**4. Budget and Resource Constraints:**

* Constraint: Development must operate within budgetary limitations and resource constraints.
* Considerations: Plan the project carefully, prioritize features based on impact, explore cost-effective technologies, and consider potential funding sources.

**5. Time Constraints:**

* Constraint: The project must adhere to predefined timelines, especially if there are critical milestones or external dependencies.
* Considerations: Establish a realistic timeline, use agile development methodologies for flexibility, and have contingency plans for potential delays.

**6. Regulatory Compliance:**

* Constraint: Compliance with local and national regulations, including zoning laws, building codes, and data protection laws.
* Considerations: Stay informed about relevant regulations, involve legal experts, and ensure that the application meets all compliance requirements.

**7. Community Engagement:**

* Constraint: Involving citizens in the development process and addressing their needs and concerns.
* Considerations: Conduct regular feedback sessions, involve citizens in beta testing, and maintain transparent communication channels.

**8. Technology Constraints:**

* Constraint: Compatibility with the devices commonly used by citizens (smartphones, tablets) and the availability of reliable internet connectivity.
* Considerations: Optimize the application for various devices, consider offline functionality, and provide alternative communication channels for those with limited internet access.

**9. Scalability:**

* Constraint: The application should be designed to handle growth in user base and increased data volume over time.
* Considerations: Use scalable infrastructure, employ cloud services, and plan for potential increases in traffic and data.

**10. Environmental Impact:**

* Constraint: Minimizing the environmental impact of the application and associated technologies.
* Considerations: Opt for energy-efficient solutions, consider the life cycle of hardware components, and implement features promoting sustainable practices.

**11. Political and Social Considerations:**

* Constraint: Considerations related to local politics, public sentiment, and social impact.
* Considerations: Engage with stakeholders, communicate transparently, and be mindful of the potential social implications of the technology.

# 6. Tasks to be completed by students

# Here's a list of tasks organized by different roles:

# 1. Project Management:

# Define project scope, objectives, and deliverables.

# Develop a project timeline with milestones.

# Allocate resources effectively.

# Implement a project management methodology (e.g., Agile, Scrum).

# 2. Research and Requirements Analysis:

# Conduct a thorough analysis of the municipality's needs and challenges.

# Research existing smart city applications for inspiration.

# Gather requirements from stakeholders, including citizens and municipal authorities.

# 3. User Interface (UI) and User Experience (UX) Design:

# Design intuitive and user-friendly interfaces for the mobile app and web portal /USE Figma).

# Create wireframes, prototypes, and design mock-ups.

# Ensure accessibility and usability for diverse users.

# 4. Frontend Development:

# Code the frontend of the mobile app (iOS, Android) and web portal.

# Implement responsive design for various devices.

# Integrate UI designs with backend functionality.

# 5. Backend Development:

# Develop the backend infrastructure using cloud-based solutions.

# Implement APIs for data exchange between frontend and backend.

# Ensure data security and privacy measures are in place.

# 6. Database Management:

# Design and implement databases for storing citizen information, service records, etc.

# Optimize/normalize databases for efficient data retrieval.

# Implement backup and recovery mechanisms.

# 7. IoT Integration (OPTIONAL):

# Integrate IoT devices for smart infrastructure (street lights, waste bins, traffic signals).

# Ensure seamless communication between devices and the application.

# Implement protocols for data exchange.

# 8. Quality Assurance and Testing:

# Develop and execute test plans for functionality, security, and performance.

# Conduct usability testing for the frontend.

# Perform regression testing after updates.

# 9. Documentation:

# Create comprehensive documentation for users and developers.

# Document the system architecture, APIs, and database structures.

# Develop user guides for citizens and municipal staff.

# 10. Security Implementation:

# Implement encryption mechanisms for data security.

# Ensure secure API communication.

# Regularly update security protocols based on best practices.

# 7. Tools Required/Expected to be used in the development of the project:

# Here is a list of recommended tools for students to use at different stages of developing their projects:

# 1. Project Management:

# Tools:

# Jira, Trello, Asana, or Microsoft Project for project planning, task assignment, and progress tracking.

# 2. Research and Requirements Analysis:

# Tools:

# Surveys and interviews for gathering requirements.

# Google Forms or SurveyMonkey for creating and conducting surveys.

# 3. User Interface (UI) and User Experience (UX) Design:

# Tools:

# Figma, Sketch, Adobe XD, or InVision for UI/UX design and prototyping.

# Balsamiq for wireframing.

# 4. Frontend Development:

# Tools:

# Visual Studio Code, Sublime Text, or Atom for code editing.

# GitHub or GitLab for version control and collaboration.

# 5. Backend Development:

# Tools:

# Node.js, Django, Flask, or Spring Boot for backend development.

# PostgreSQL, MongoDB, or MySQL for database management.

# 6. Database Management:

# Tools:

# MySQL Workbench, pgAdmin, or MongoDB Compass for database administration.

# 7. IoT Integration (OPTIONAL):

# Tools:

# Platform-specific SDKs for IoT device integration.

# MQTT or CoAP for IoT communication protocols.

# 8. Quality Assurance and Testing:

# Tools:

# Selenium or Cypress for automated testing.

# Postman or Insomnia for API testing.

# JUnit or TestNG for unit testing in Java.

# 8. Resources Required (HW/SW/Data, etc.)

# Some possible resources are required:

# 1. Human Resources:

# Development Team:

# Project Manager

# Frontend Developers

# Backend Developers

# UI/UX Designers

# Database Administrators

# IoT Specialists

# Quality Assurance/Testers

# Documentation and Training Specialists

# 2. Hardware (some of Optional):

# Computer

# Servers and infrastructure for hosting the application, databases, and IoT devices.

# IoT devices (sensors, actuators) for smart infrastructure integration.

# 3. Software:

# Development tools and environments (IDEs, version control systems).

# Database management systems (e.g., PostgreSQL, MongoDB).

# Operating systems for servers and hosting platforms.

# 4. Technological Infrastructure:

# Cloud services (AWS, Azure, Google Cloud) for scalable and reliable hosting.

# IoT platforms for managing and monitoring IoT devices.

# 5. Communication and Collaboration Tools:

# Project management tools (MS project, Jira, Trello, Asana) for planning and collaboration.

# Communication tools (Slack, Microsoft Teams) for team communication.

# Video conferencing tools for virtual meetings and training sessions.

# 6. Testing and Quality Assurance Tools:

# Automated testing tools (Selenium, Cypress) for ensuring code quality.

# API testing tools (Postman, Insomnia) for testing backend functionality.

# Security testing tools (OWASP ZAP, Burp Suite) for identifying vulnerabilities.

# 7. Documentation Tools:

# Collaboration platforms for creating and maintaining project documentation (MS Word, Confluence, Google Docs).

# API documentation tools (Swagger, OpenAPI) for documenting APIs.

# Complete list of Project Deliverables Expected at the End of Project Completion

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| --- | --- |
| Deliverable | Description |
| IT support software | Solutions to improve customer relations |
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(add more rows as needed)

# 10. Other related information

Hints and ideas that will help students in the development of the project. These may include pointers to similar projects, resources such as books, web sites etc.

*Smart City Application may be useful to users by containing the following features (it is given for example purposes, its implementation is not mandatory, students can determine their own application features):*

***1. Real-time Information:***

*Scenario: A citizen opens the app to check real-time traffic conditions before heading to work.*

*Application Feature: The app provides live traffic updates, suggesting alternative routes and estimated travel times based on current road conditions.*

***2. Citizen Engagement:***

*Scenario: A resident notices a streetlight out on their evening walk and wants to report it.*

*Application Feature: Using the "Report an Issue" feature, the user uploads a photo and notes the location. The municipal team receives an immediate notification and schedules repairs.*

***3. Smart Infrastructure:***

*Scenario: The municipality aims to reduce energy consumption in street lighting.*

*Application Feature: The app integrates with smart streetlights, adjusting brightness based on real-time data. Citizens can also view energy-saving statistics.*

***4. Public Safety:***

*Scenario: A citizen witnesses a road accident and needs to report it.*

*Application Feature: The "Emergency Reporting" feature allows users to report incidents with location details. Emergency services receive immediate alerts and can respond accordingly.*

***5. Data Analytics:***

*Scenario: Municipal planners want insights into waste generation patterns.*

*Application Feature: The app provides analytics on waste collection frequencies, helping authorities optimize routes and schedules for efficiency.*

***6. IoT Integration:***

*Scenario: The municipality installs smart waste bins with fill-level sensors.*

*Application Feature: Citizens can check the app for nearby empty bins, reducing overflow issues. The system notifies waste collection teams when bins are full.*

***7. Security and Privacy:***

*Scenario: A user wants to ensure the security of personal data stored in the app.*

*Application Feature: The app employs end-to-end encryption, secure login methods, and transparent data handling practices to protect user privacy.*

***8. Reporting and Analytics:***

*Scenario: A municipal official needs a report on citizen feedback trends.*

*Application Feature: The app generates reports on the frequency and nature of citizen feedback, helping authorities address community concerns effectively.*

***9. Community Engagement:***

*Scenario: The municipality plans a town hall meeting to discuss upcoming projects.*

*Application Feature: The app sends event notifications to users, encouraging attendance and participation. Users can submit questions or feedback through the app.*

***These examples demonstrate how the Municipality Smart City Application features can address real-world scenarios, providing value to both citizens and municipal authorities.***

***SOME EXAMPLES:***

Here are some examples that were known as of my last update:

**DubaiNow (Dubai, UAE):** Provides a wide range of smart services for residents and visitors, including bill payments, government services, and real-time information.

**Seoul Smart City (Seoul, South Korea):** Offers various smart services, such as public transportation information, facility reservations, and citizen engagement features.

**MyLA311 (Los Angeles, USA):** Allows residents to report issues, such as potholes or graffiti, directly to the city. It also provides access to various city services.

**Copenhagen City App (Copenhagen, Denmark):** Provides information on public transportation, bike routes, and real-time updates on city events. It encourages sustainable transportation.

**Singapore OneService App (Singapore):** Enables citizens to report municipal issues and provides information on government services. It aims to enhance the overall living experience in Singapore.

**NYC 311 (New York City, USA):** Allows New York City residents to access a variety of non-emergency services and information, including reporting issues and checking service requests.

**SmartDubai (Dubai, UAE):** Focuses on providing citizens with access to government services, information, and smart initiatives within the city.

**Bengaluru (Bangalore) Traffic Police App (Bengaluru, India):** Helps residents navigate through the city by providing real-time traffic updates, reporting issues, and paying fines.

**Barcelona Citizen App (Barcelona, Spain):** Offers services such as public transportation information, cultural events, and allows citizens to report issues to the local government.

**Boston 311 (Boston, USA):** Allows residents to report issues, ask questions, and access various city services to enhance their interaction with local government.

**SOME FEATURES COMMONLY USED BY SEVERAL MUNICIPALITIES:**

1. News and Announcements: Informing about the municipality's current news, announcements, and events.
2. Online Payments: Online access and payment for municipal services such as tax payments and water bills.
3. Tender Announcements: Announcements and relevant documents regarding the municipality's tenders.
4. Live Cameras and Traffic Information: Checking city routes through real-time traffic conditions via live cameras.
5. Events and Cultural Affairs: Information and reservation options for cultural events like concerts, festivals, and exhibitions.
6. Disaster and Emergency Information: Information and guidance regarding emergencies or natural disasters.
7. Environmentally Friendly Services: Information about recycling days, green areas, and environmentally friendly practices.
8. Complaint and Request Forms: Online forms for citizens to submit complaints or requests to the municipality.
9. Pharmacies on Duty and Health Information: Locations and information of pharmacies on duty and healthcare facilities.
10. Road Conditions and Construction Information: Information about city road conditions, closed roads, and construction projects.
11. Social Media Integration: Easy access to the municipality's social media accounts and updates.
12. Education and Information: Municipality-organized education programs, seminars, and other informational events.
13. Social Aid and Support Programs: Information on social aid programs, support, and application details for citizens.
14. Municipality Helpline: Direct communication with the municipality via phone or live chat.
15. Complaint Panel with Photos: A panel where citizens can submit complaints, including photos, about issues like waste or road conditions.